Demonstration/Validation of Step Infiltration at a Southeastern Army Installation

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US Army Corps of Engineers
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Energy Independence and Security Act of 2007

SEC. 438

STORM WATER RUNOFF REQUIREMENTS FOR FEDERAL DEVELOPMENT PROJECTS

"The sponsor of any development or redevelopment project involving a Federal facility with a footprint that exceeds 5,000 square feet shall use site planning, design, construction, and maintenance strategies for the property to maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property with regard to the temperature, rate, volume, and duration of flow."

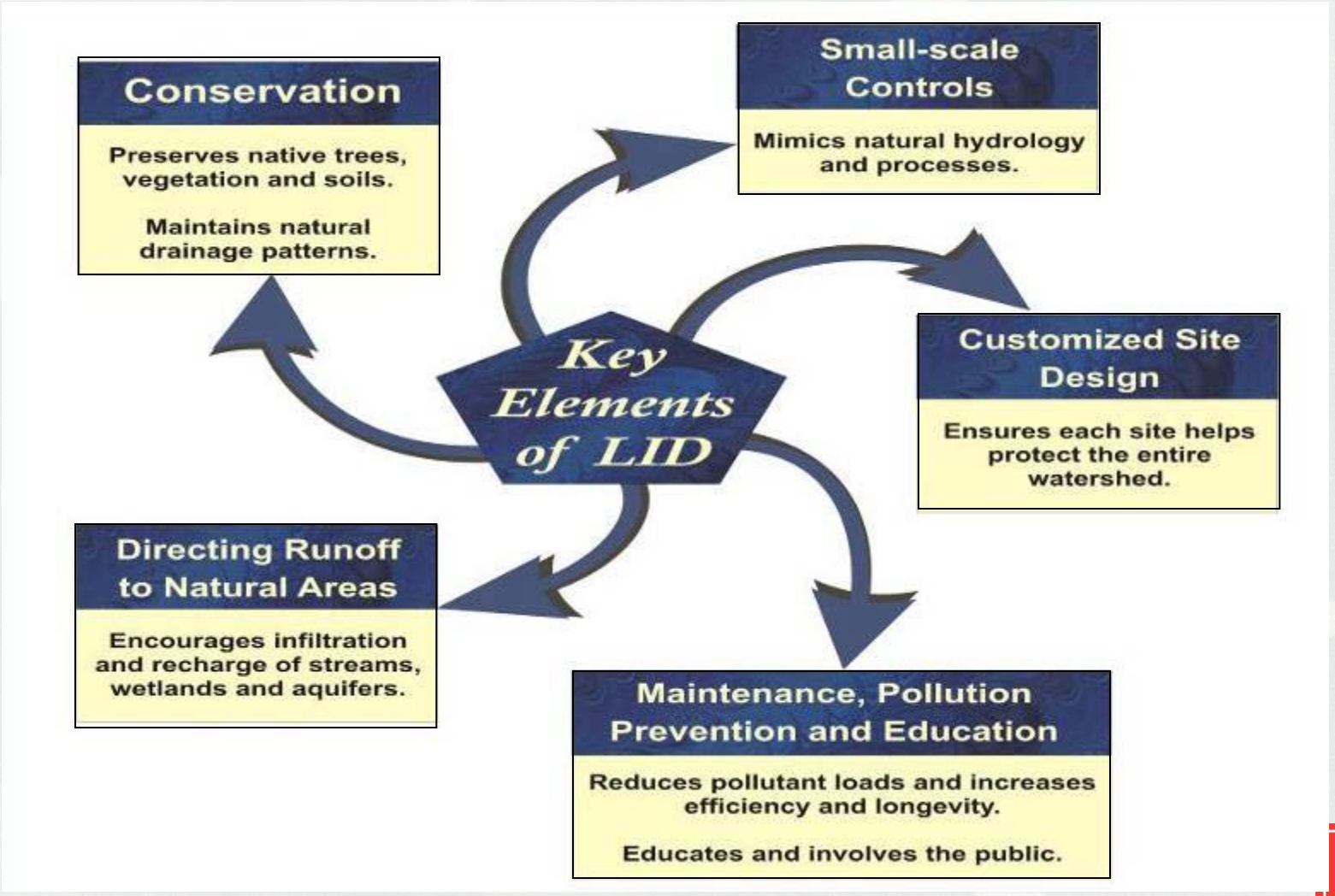
Wow! This is a really high hurdle…and it seems to conflict with 100+ years of drainage practice

Principles of Low Impact Development (LID)

- EISA, Section 438 and other Army guidance promotes LID approaches over more traditional approaches for stormwater management.
- Manage stormwater close to where precipitation lands.
- Maintain or restore pre-development hydrology, reduce runoff volume and peak runoff rates and reduce potential transport of pollutants to receiving waters.
- Widely proven in nonmilitary applications.
- One limit to mass Army adoption has been lack of demonstrations while combating a perception of increased costs.

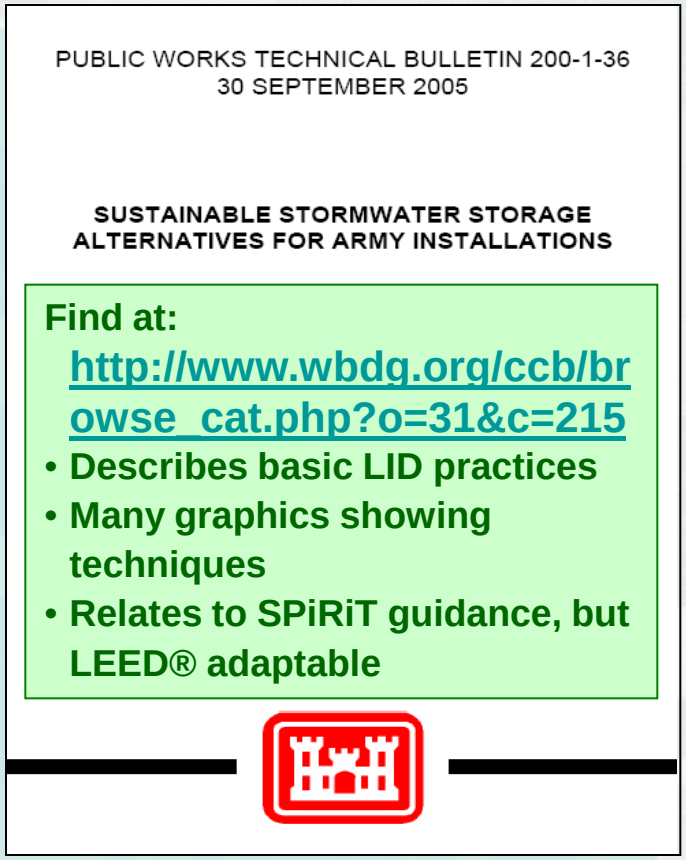
Low Impact Development (LID)

principles in a nutshell

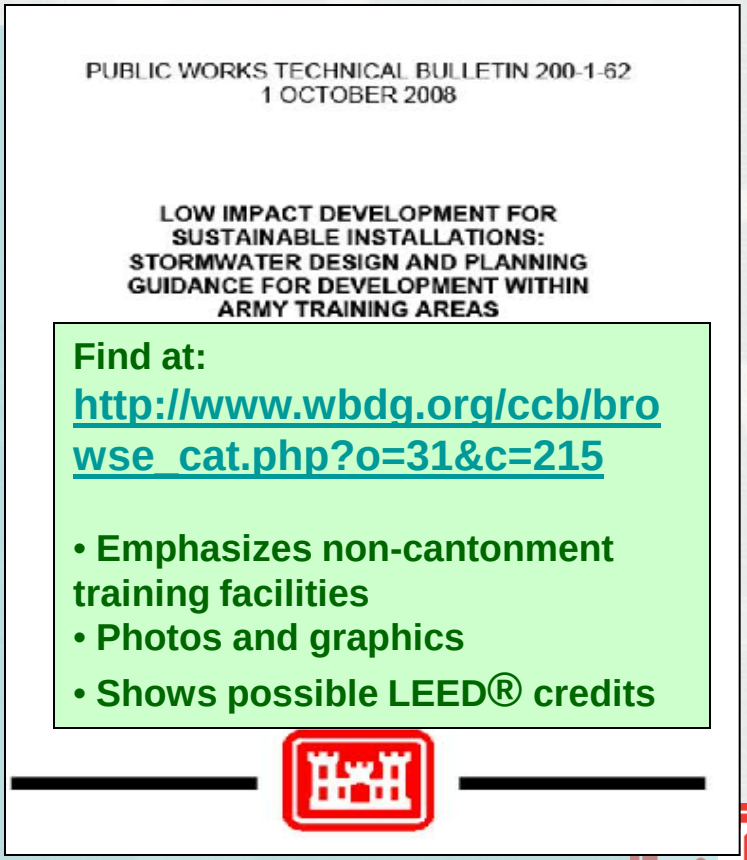


But, ERDC and the Corps have already addressed the question!

(Before Section 438 was published)



PWTB 200-1-36



PWTB 200-1-62

Easiest technique is to search for PWTB by number

Representative technologies

- Bioretention cells
- Permeable pavement
- Bioswales
- Rain gardens
- Others

LID Examples

Project Emphasis

- Protect jurisdictional wetlands
- Address and mitigate impact on installation wetlands
- Implement corrective actions for outfalls which can degrade water quality and fill in wetlands
- Support Clean Water Act
- Original intent to upgrade structure, control runoff volume and reduce velocity of stormwater discharge
- Utilize LID with conventional approaches as needed
- Bioretention facilities, modifications to discharge channels, infiltration swales
- Expected results: filtration of metals and surfactants, reduction in quantity of runoff, improved quality of runoff
- Options for groundwater recharge
- Conduct demonstrations, monitor, collect data.

Focus Change

- State inspection prompted emphasis on one site
- Upstream tenant had constructed detention basin with inadequate design
- Also nearby landfill cap washout.
- Result – major erosion problem.

This is the start of the problem


30 inch drain from tenant’s retention basin


Siltation threatens wetland area

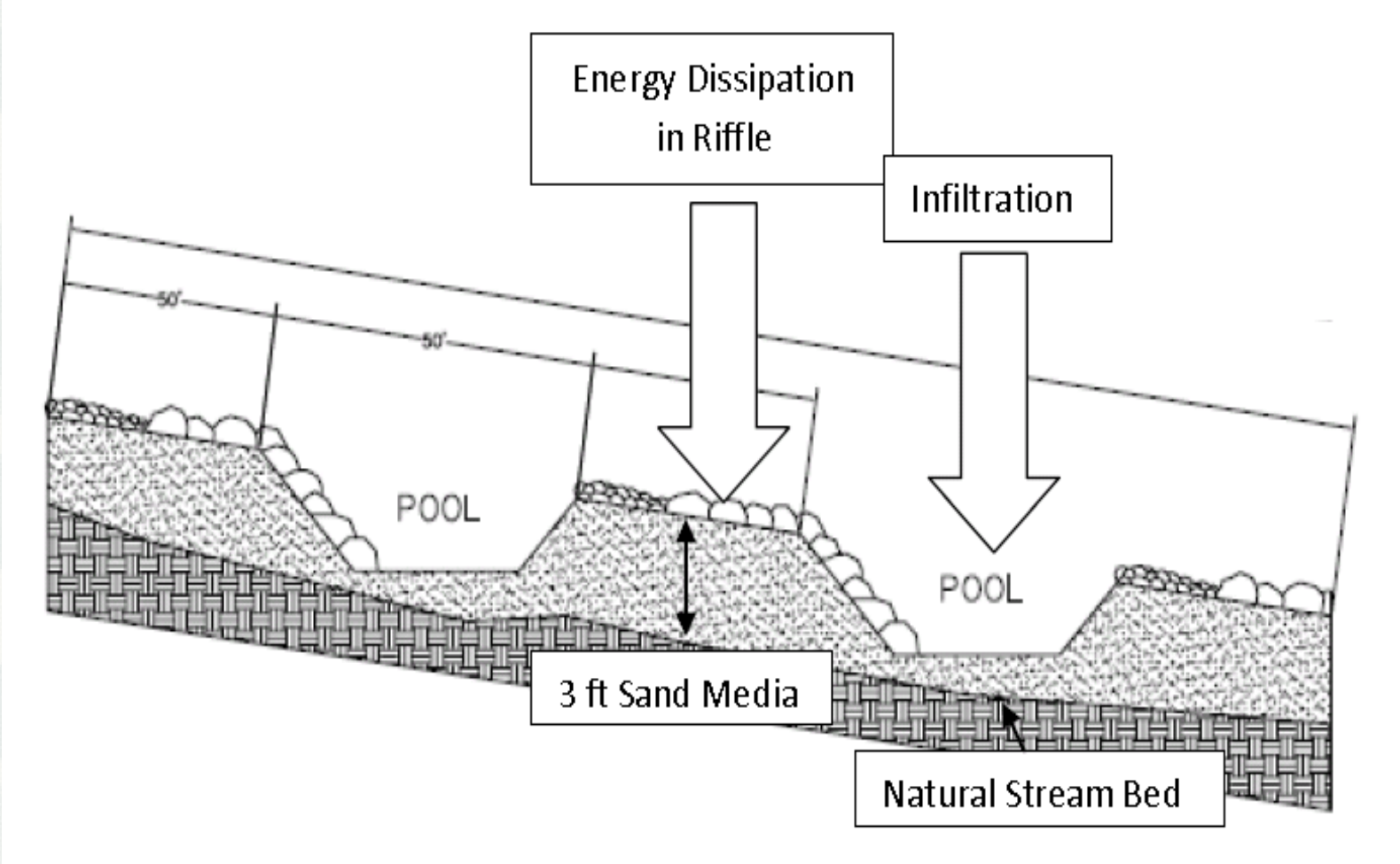
Planning a Solution

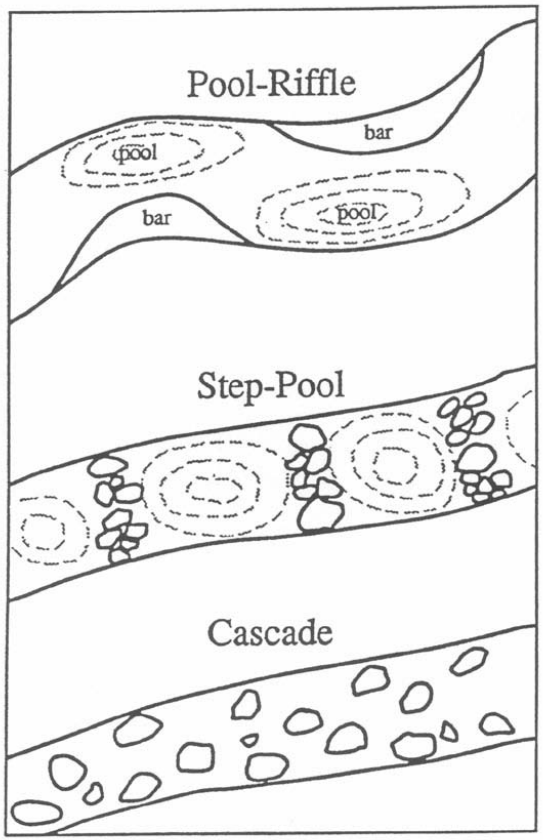
- Selecting possible treatments
- Evaluating tenant's catchment outfall structure
  - Outlet non-functional
  - Redesign for staged release
- Reality check

Step Infiltration Demonstration

- Step Pool Storm Conveyance
- LID open channel approach
- Best suited for ditches, outfalls, ephemeral and intermittent channels with slopes
- Improve infiltration, convert to groundwater flow
- Reduce risk of sedimentation from high intensity storm events
- Capture essential components, demonstrate, validate
- Adapt regional specifics
- Appropriate conditions for maximal effectiveness

Planning a Solution




Pool-Riffle
bar
pool
bar
pool
Step-Pool
Cascade

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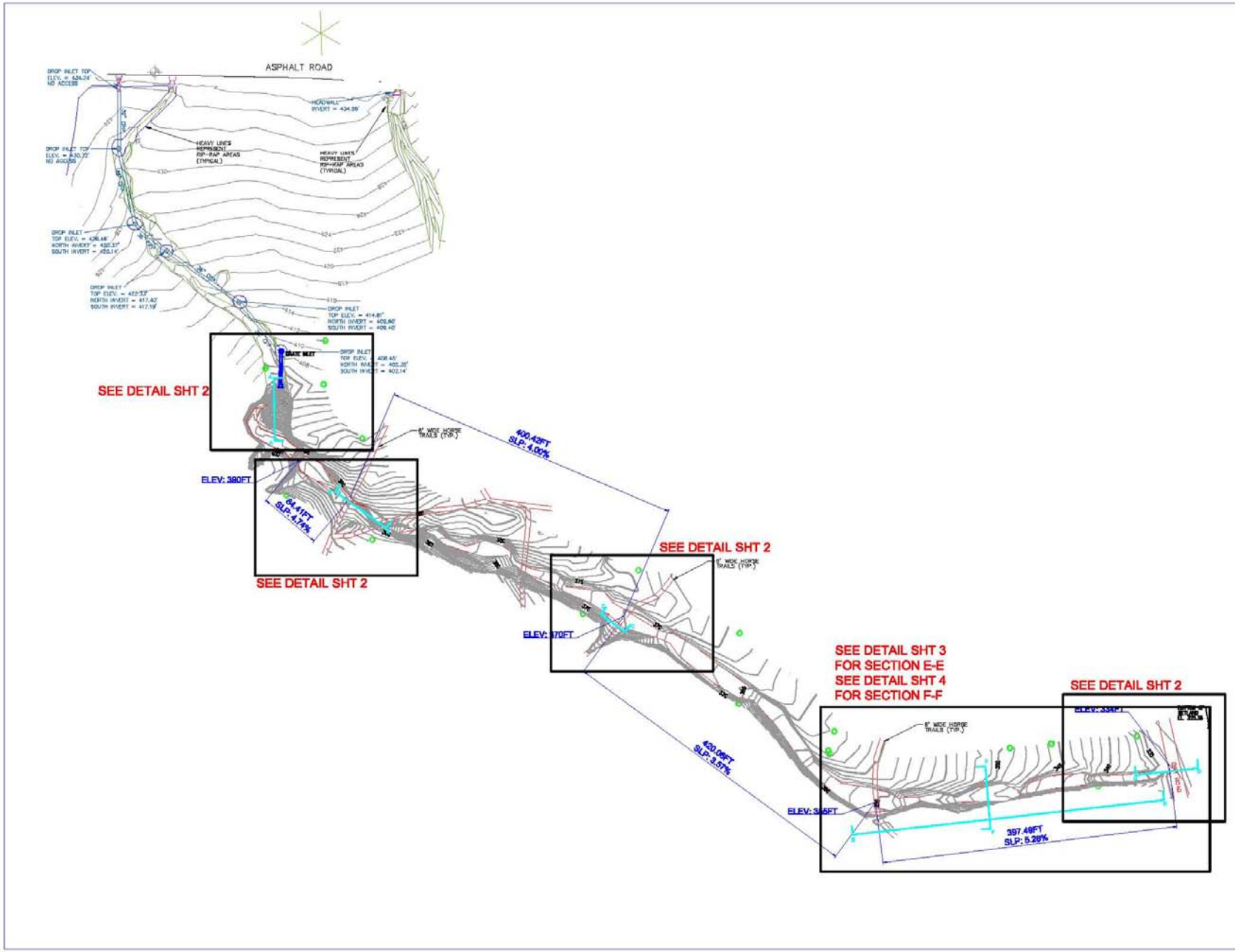
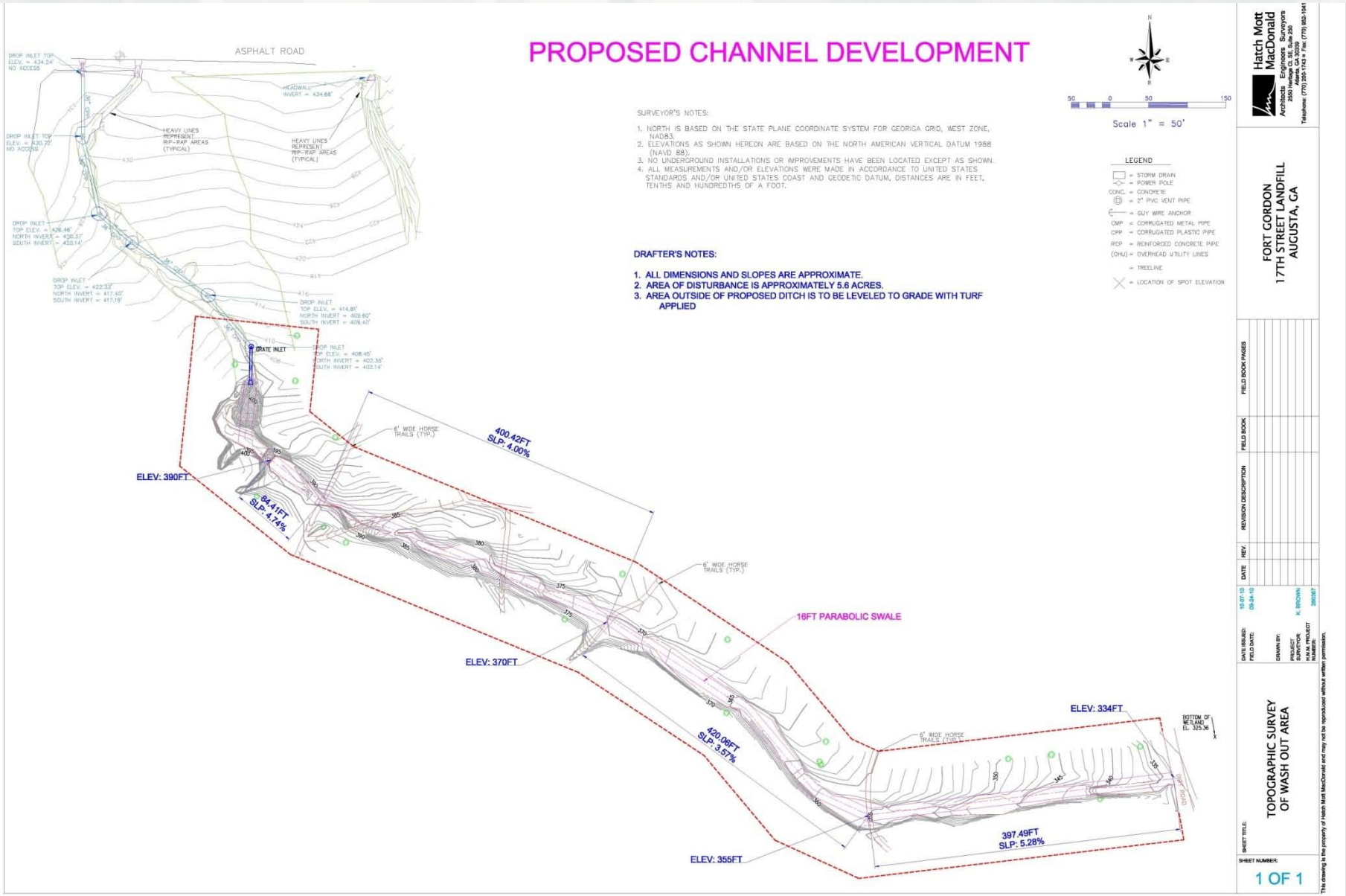
Step Infiltration – A Preferred Approach


ASPHALT ROAD
SEE DETAIL SHT 2
SEE DETAIL SHT 2
400.43FT
SLP: 4.00%
ELEV: 390FT
84.41FT
SLP: 4.74%
SEE DETAIL SHT 2
SEE DETAIL SHT 3
FOR SECTION E-E
SEE DETAIL SHT 4
FOR SECTION F-F
SEE DETAIL SHT 2
420.06FT
SLP: 3.57%
397.49FT
SLP: 5.28%


PROPOSED CHANNEL DEVELOPMENT
ASPHALT ROAD
SURVEYOR'S NOTES:
1. NORTH IS BASED ON THE STATE PLANE COORDINATE SYSTEM FOR GEORGIA GRID, WEST ZONE, NAD83.
2. ELEVATIONS AS SHOWN HEREON ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88).
3. NO UNDERGROUND INSTALLATIONS OR IMPROVEMENTS HAVE BEEN LOCATED EXCEPT AS SHOWN.
4. ALL MEASUREMENTS AND/OR ELEVATIONS WERE MADE IN ACCORDANCE TO UNITED STATES STANDARDS AND/OR UNITED STATES COAST AND GEODETIC DATUM. DISTANCES ARE IN FEET, TENTHS AND HUNDREDTHS OF A FOOT.
DRAFTER'S NOTES:
1. ALL DIMENSIONS AND SLOPES ARE APPROXIMATE.
2. AREA OF DISTURBANCE IS APPROXIMATELY 5.6 ACRES.
3. AREA OUTSIDE OF PROPOSED DITCH IS TO BE LEVELED TO GRADE WITH TURF APPLIED
Scale 1" = 50'
LEGEND
= STORM DRAIN
= POWER POLE
CONC. = CONCRETE
= 2" PVC VENT PIPE
= GUY WIRE ANCHOR
CMP = CORRUGATED METAL PIPE
CPP = CORRUGATED PLASTIC PIPE
RCP = REINFORCED CONCRETE PIPE
(OHU) = OVERHEAD UTILITY LINES
= TREELINE
= LOCATION OF SPOT ELEVATION
DROP INLET TOP ELEV. = 434.24' NO ACCESS
HEADWALL INVERT = 434.68'
HEAVY LINES REPRESENT RIP-RAP AREAS (TYPICAL)
DROP INLET TOP ELEV. = 430.75' NO ACCESS
DROP INLET TOP ELEV. = 426.46' NORTH INVERT = 420.37' SOUTH INVERT = 420.14'
DROP INLET TOP ELEV. = 422.33' NORTH INVERT = 417.40' SOUTH INVERT = 417.19'
DROP INLET TOP ELEV. = 414.81' NORTH INVERT = 409.60' SOUTH INVERT = 409.40'
GRATE INLET
DROP INLET TOP ELEV. = 408.46' NORTH INVERT = 402.35' SOUTH INVERT = 402.14'
6' WIDE HORSE TRAILS (TYP.)
400.42FT SLP: 4.00%
ELEV: 390FT
84.41FT SLP: 4.74%
16FT PARABOLIC SWALE
ELEV: 370FT
420.06FT SLP: 3.57%
ELEV: 334FT
BOTTOM OF WETLAND EL. 325.36
397.49FT SLP: 5.28%
ELEV: 355FT
Hatch Mott MacDonald
Architects Engineers Surveyors
3550 Heritage Ct. SE, Suite 250
Atlanta, GA 30339
Telephone: (770) 350-1143 • Fax: (770) 955-1041
FORT GORDON
17TH STREET LANDFILL
AUGUSTA, GA
FIELD BOOK PAGES
FIELD BOOK
REVISION DESCRIPTION
REV.
DATE
DATE ISSUED: 10-07-10
FIELD DATE: 09-24-10
DRAWN BY: K. BROWN
PROJECT SURVEYOR:
H.M.M. PROJECT NUMBER: 280087
SHEET TITLE:
TOPOGRAPHIC SURVEY OF WASH OUT AREA
SHEET NUMBER:
1 OF 1
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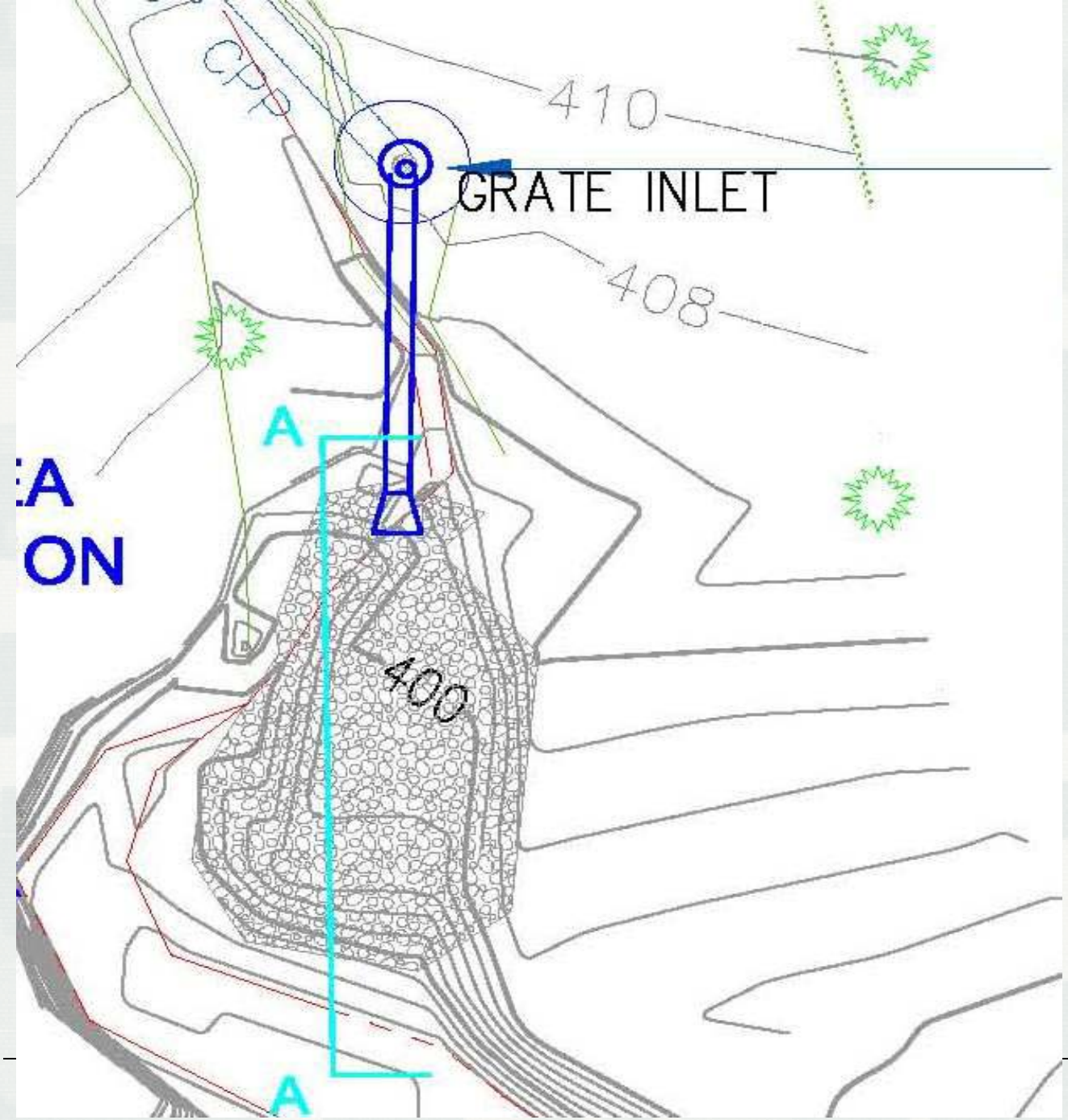
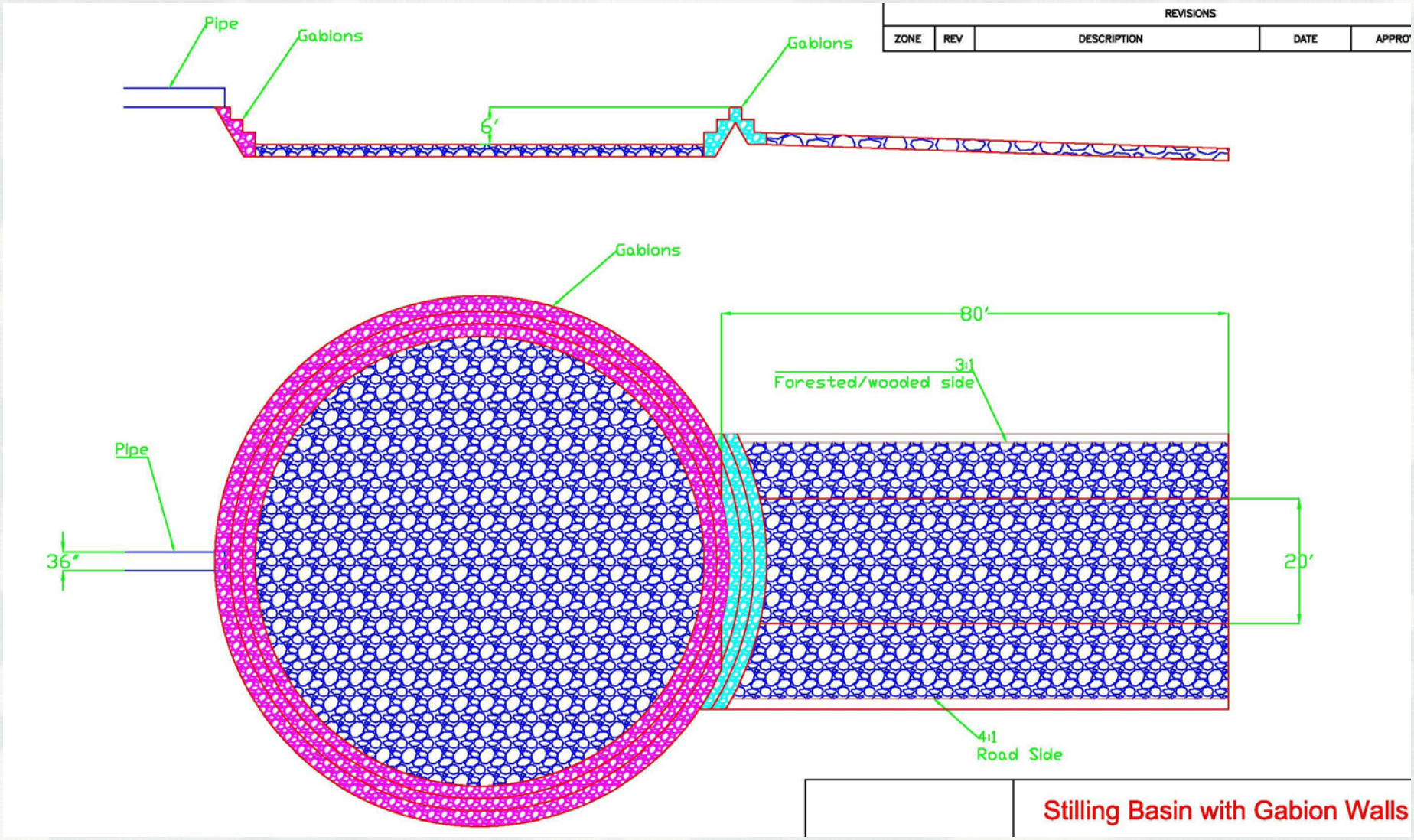
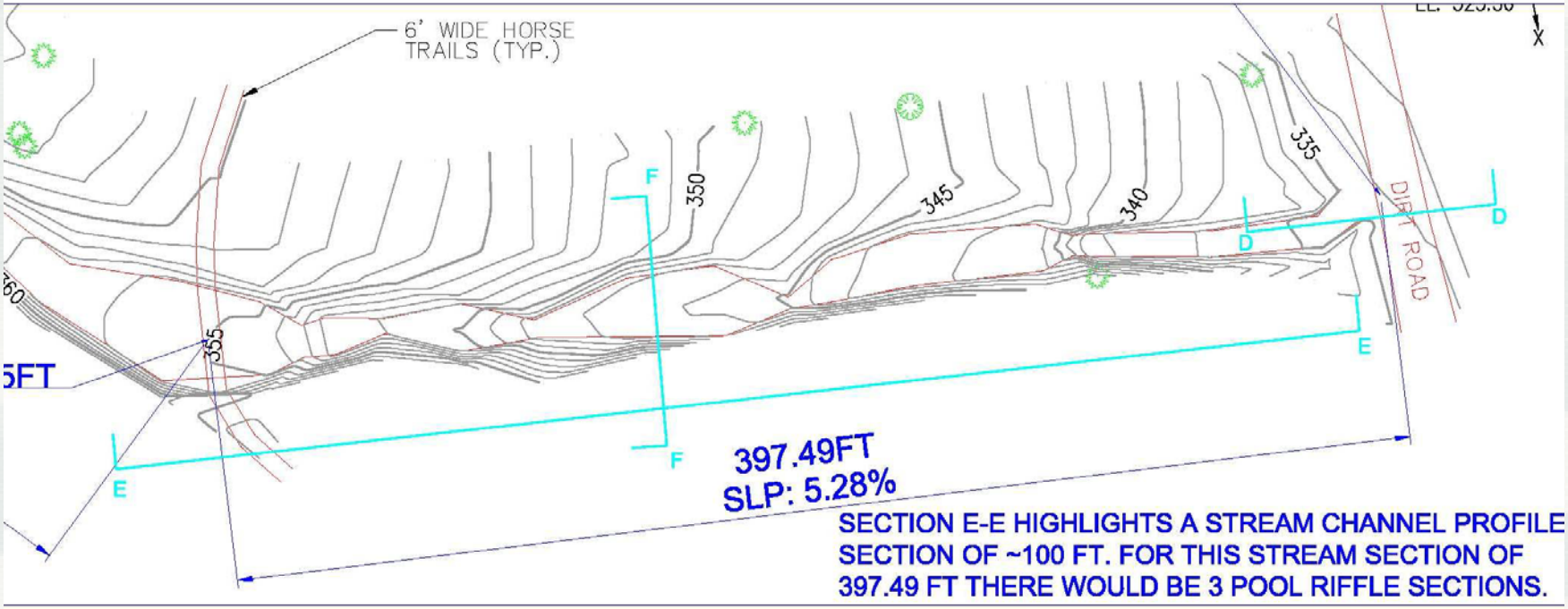
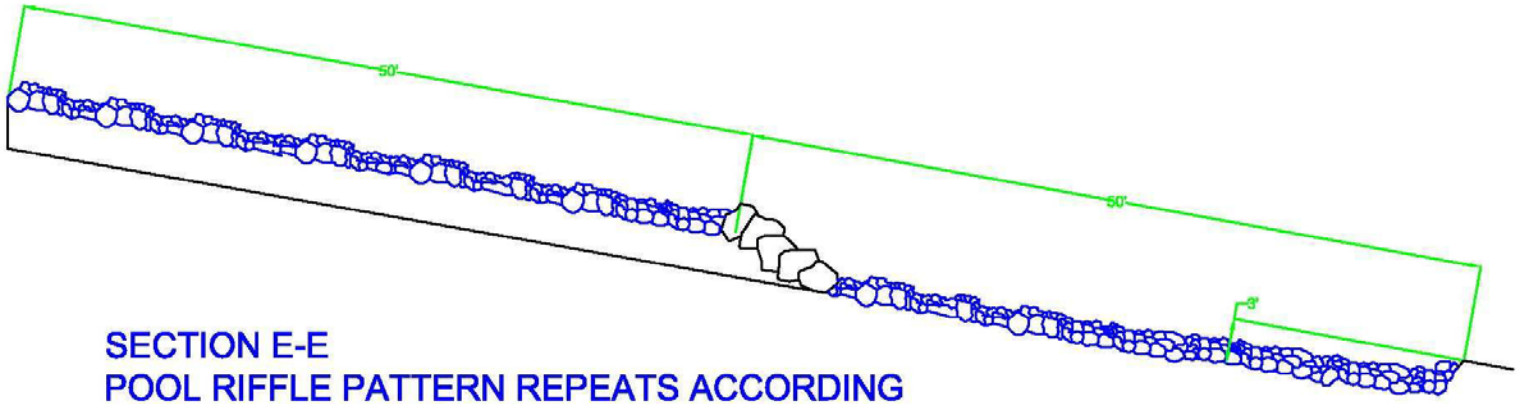

CPP
410
GRATE INLET
408
A
400
A


REVISIONS
ZONE
REV
DESCRIPTION
DATE
Pipe
Gabions
Gabions
6'
Gabions
80'
3:1
Forested/wooded side
Pipe
36"
20'
4:1
Road Side
Stilling Basin with Gabion Walls

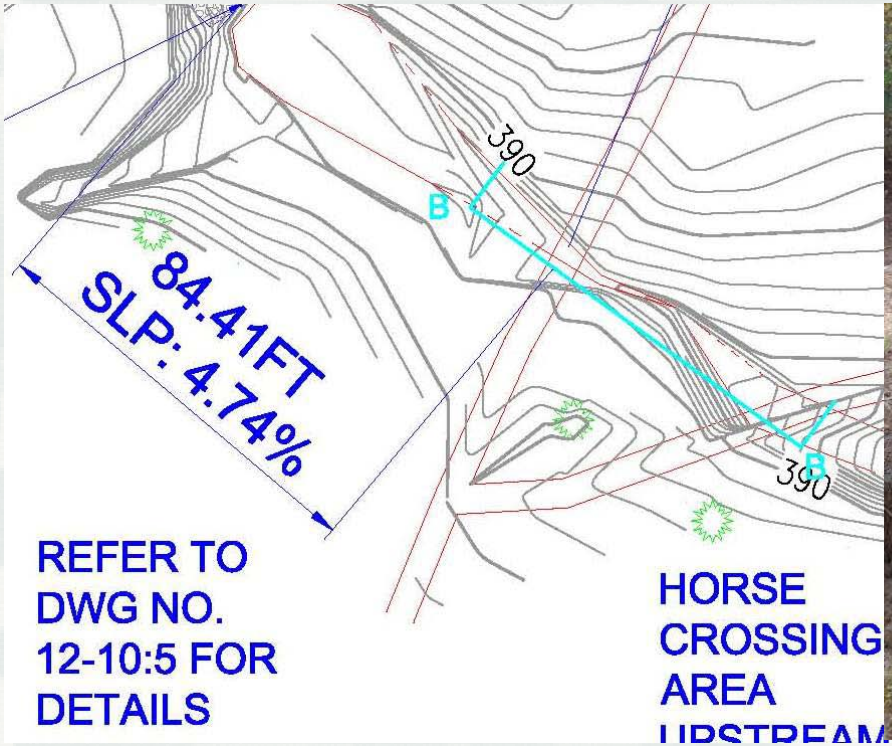


SECTION E-E HIGHLIGHTS A STREAM CHANNEL PROFILE SECTION OF ~100 FT. FOR THIS STREAM SECTION OF 397.49 FT THERE WOULD BE 3 POOL RIFFLE SECTIONS.



SECTION E-E
POOL RIFFLE PATTERN REPEATS ACCORDING TO DIMENSIONAL CONSTRAINTS OF STREAM CHANNEL PROFILE ~50' (TYP.)

Planning a Solution



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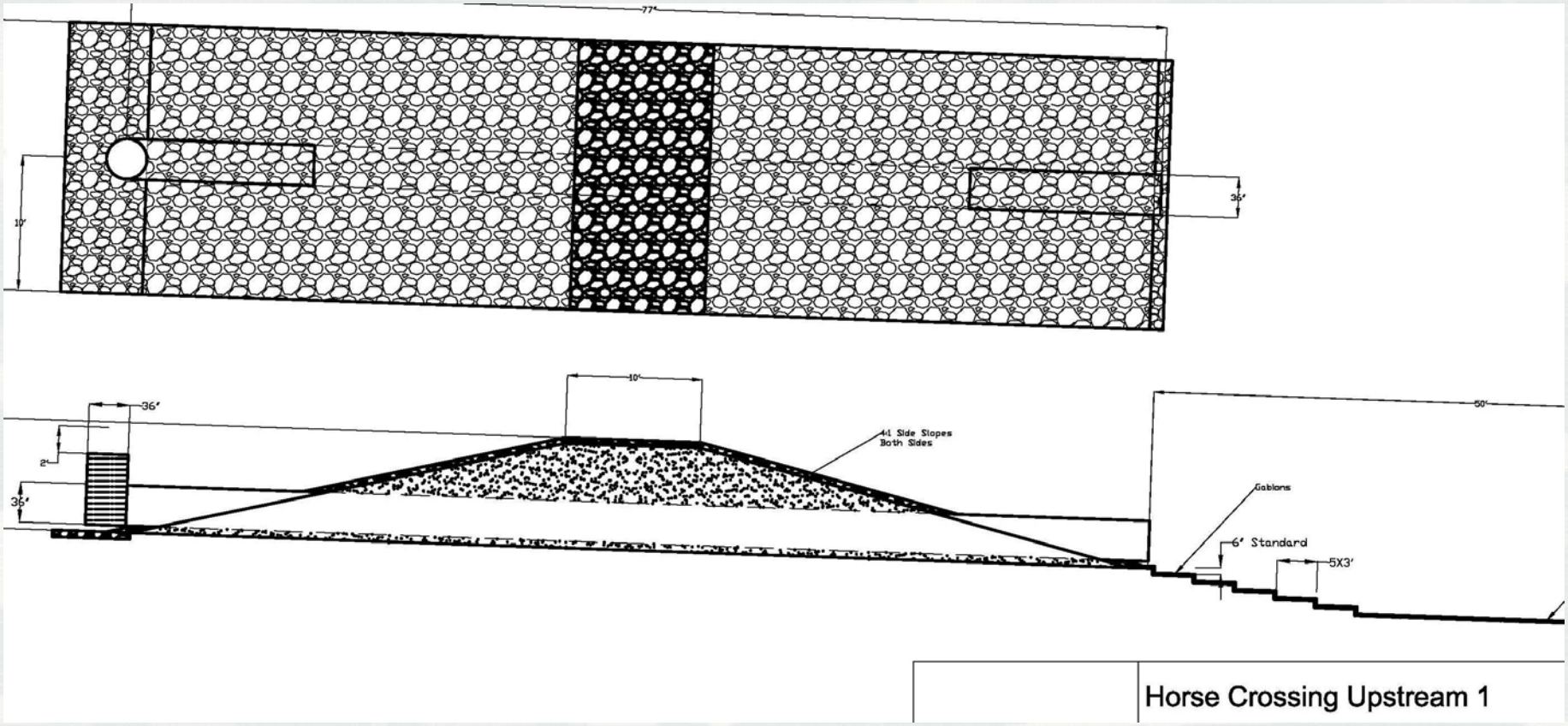
Planning a Solution



Summary

- LID testbed demo needed validation
- Overcome by high priority problem
- Solutions must be compatible
  - Appropriate to magnitude of problem
  - Compatible with environmental setting
  - Step infiltration should take care of reduction in sediment and flow while recharging subsurface

Questions, Comments?

Contact information or for additional information or resources

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217-398-5590